Amendments to the Specification

Please replace the paragraph beginning at page 5, line 18 with the following rewritten paragraph:

--In one aspect of the invention there is provided a system for producing a cladding on a substrate, comprising:

a) a laser for processing materials and focusing means for directing and focusing a laser light beam from said laser onto a substrate surface, a substrate holder and positioning means for adjusting the position of the laser light beam and the substrate with respect to each other, and powder injection means for injecting powder onto said substrate;

b) image detection means for capturing images of an interaction region between said laser light beam and powder injected onto said substrate surface; and

c) a computer control means connected to said laser, said positioning means and said powder injection means, wherein said computer control means includes modeling means to model cladding growth by laser processing of powder, and extract from said model desired values for the pre-selected properties of the growing clad in real-time, and said computer control means including image processing means for [[the]] processing images of the interaction region between said laser light beam and the powder injected onto said substrate surface and extracting from said images ~~dimensions and rate of solidification~~ values of pre-selected properties of [[the]] a growing clad in real-time, said computer control means including processing means to compare said ~~dimensions and rate of solidification~~ extracted values of said pre-selected properties of the growing clad in real-time to desired values of ~~dimensions and rate of solidification~~ said pre-selected properties of the growing clad produced by ~~an effective model of cladding growth by laser processing of powder, said computer control means adjusting parameters of said laser light beam, powder~~

~~feedrate and positioning means based on a differences between the dimensions and rate of solidification of the clad in real-time and said desired values of the dimensions and rate of solidification~~ a model of cladding growth by laser processing of powder, and wherein said image processing means includes pattern recognition processing means to extract the pre-selected properties of a growing clad in real-time from images captured by the image detection means, said computer control means including intelligent process controller means interfaced to said laser, said intelligent process controller being a fuzzy logic controller including fuzzy logic membership functions, an inference engine and a defuzzification module, wherein said fuzzy logic membership functions are utilized to fuzzify the difference between first input signals, which are said extracted values of the pre-selected properties of the growing clad in real-time extracted by said pattern recognition processing means, and second input signals which are the desired values of the pre-selected properties of the growing clad, and wherein the inference engine combines the fuzzified difference between said first and second input signals, and wherein the defuzzification module defuzzifies outputs of the inference engine to convert them back into quantitative values, said quantitative values being output from the intelligent process controller means and used to adjust parameters of said laser light beam, the positioning means and said powder injection means to give the desired values of the pre-selected properties of the clad. --

Please replace the paragraph beginning at page 6, line 18 with the following rewritten paragraph:

-- In another aspect of the invention there is provided a method for producing a cladding on a substrate, comprising:

a) injecting powder onto a surface of a substrate and directing and focusing a laser light beam having effective laser light beam parameters onto the substrate surface;

b) capturing images of an interaction region between the laser light beam and the powder injected onto the substrate surface using at least two image detectors; and

c) processing the captured images of the interaction region between the laser light beam and the powder injected onto the substrate surface and extracting from the images pre-selected properties of [[the]] a clad in real-time by merging of the images received from the at least two image detectors using an effective morphological structuring element neighborhood method, and to obtain therefrom two matrices, one of the matrices being a boundary matrix representing the clad's boundaries on the substrate and another matrix being an overlap matrix representing the overlap between the two images captured by the at least two image detectors, and calculating a difference between the extracted pre-selected properties to desired values of the pre-selected properties produced by an effective model of cladding growth by laser processing of powder, and using the difference to adjust processing parameters to ~~substantially~~ give the desired real time values of the pre-selected properties of the clad. --

Please add the following new paragraph at page 7, after line 10:

--A method for producing a cladding on a substrate, comprising:

a) injecting powder onto a surface of a substrate and directing and focusing a laser light beam onto the substrate surface;

b) capturing images of an interaction region between the laser light beam and the powder injected onto the substrate surface; and

c) processing the captured images of the interaction region between the laser light beam and the powder injected onto the substrate surface and extracting from the images pre-selected properties of a growing clad in real-time, and calculating a difference between the extracted pre-selected properties to desired values of the pre-selected properties produced by an effective model of cladding growth by laser processing of powder, the step of calculating the difference between the extracted pre-selected properties to preferred values of the pre-selected properties produced by an effective model of cladding growth by laser processing of powder including fuzzifying the difference between the extracted pre-selected properties of the growing clad in real-time and the desired values of the pre-selected properties of the growing clad, combining the fuzzified difference between the extracted pre-selected properties and the desired values of the pre-selected properties of the growing clad using an inference engine to produce fuzzified outputs, and defuzzifying the fuzzified outputs to produce quantitative values, and using said quantitative values to adjust processing parameters to give the desired values of the pre-selected properties of the clad.--

Please delete the paragraph beginning at page 7, line 11 and ending at page 7, line 21.

~~In another aspect of the invention there is provided a method of producing an iron-aluminum clad on a surface of a substrate by laser processing, comprising the steps of:~~

~~directing a stream of pre-mixed Fe and Al powders onto a surface of a substrate, pre-mixed to a specified bulk composition, and directing a laser beam onto the surface of the substrate which is simultaneously melted by the laser beam along with the powder such that melted powder mixes with the molten substrate surface; and~~

~~cooling the heated area of the substrate where upon cooling, the molten substrate surface and molten powder solidify and a fusion bond is formed between the clad material and substrate~~.

Please replace the paragraph beginning at page 17, line 15 and ending at page 18, line 7, with the following rewritten paragraph:

--The intelligent process controller can be based on different existing control methods including fuzzy logic, neural network, PID controller, state space, and the like. A fuzzy controller and a model-based nonlinear controller has been developed as part of system 10. The controller developed for system 10 has three distinct parts: (1) Fuzzy logic Membership Functions (FMF), (2) ~~interference~~ inference engine and (3) defuzzification module. The FMF are utilized to fuzzify the difference between the inputs, which are the analogue signals from CCD-based optical detectors' interface (clad height, clad width, rate of solidification and clad roughness) and the desired clad characteristics. The desired clad characteristics include geometrical properties (height, width) provided by the CAD/CAM module and roughness and rate of solidification supplied to the controller by the user. The fuzzifications are performed using the defined membership functions. In the fuzzification process quantities are replaced with qualitative linguistic parameters as discussed in J.S.R. Jang, C.T. Sun and E.Mizutani "Neuro-Fuzzy and Soft Computing" Prentice Hall, 1997. Some of the rules used in the controller are as follows:--

Please replace the paragraph beginning at page 18, line 16 with the following rewritten paragraph:

--The outputs of the fuzzifications are then fed into the ~~interference~~ inference engine such as Mamdani as discussed in J.S.R. Jang, C.T. Sun and E.Mizutani "Neuro-Fuzzy and Soft Computing" Prentice Hall, 1997 to combine the rules. The outputs of the ~~interference~~ inference engine are fed into the defuzzification module where qualitative parameters are converted back into quantitative values. The outputs of the controller are sent to the laser, positioning device and powder feeder through the interfaces. --